

# Intrinsically Safe Pressure and Temperature Transducers (PTX Series)

## User's Manual



This manual contains important information for the safe and effective operation of the Swagelok® Intrinsically Safe Pressure and Temperature Transducers, PTX series. Users must read and understand its contents before operating the transducer.

Swagelok®

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**Safety**


**Safety Summary**

 **Read the entire safety information section and User's Manual before using this product. Failure to do so can result in serious injury or death.**

**Signal Words and Safety Alert Symbols Used in this Manual**

- WARNING**      Statements that indicate a hazardous situation which, if not avoided, could result in death or serious injury.
- CAUTION**      Statements that indicate a hazardous situation which, if not avoided, could result in minor or moderate injury.
- NOTICE**        Statements that indicate a hazardous situation which, if not avoided, could result in damage to the equipment or other property.

      Safety alert symbol indicating a potential personal injury hazard.

      Safety alert symbol indictating a potential danger to life or of serious injuries due to catapulting parts.

## Safety Instructions



For proper and safe operation, Swagelok intrinsically safe PTX series transducers must be installed, operated, and serviced according to applicable local regulations and these instructions. Otherwise, serious personal injuries, damage or both can occur.



Except for adjusting the length of the wires, the electrical connection provided on the transducer must be used as originally supplied and not bypassed. Only qualified persons should work on these instruments.



Do not exceed the overpressure rating.



Before servicing any installed pressure transducer you must

- disconnect power
- depressurize system
- purge the transducer



Residual material may be left in the transducer and system.

## Introduction

The Swagelok Intrinsically Safe Pressure and Temperature Transducer (PTX) is an industrial pressure and temperature transducer for monitoring fluid pressure and temperature in automated fluid systems using a MEMS pressure-sensing technology. The PTX provides two analog outputs to monitor fluid pressure and temperature in automated fluid systems. Each PTX communicates directly with the Swagelok Intrinsically Safe Intelligent Control Module™ (ICM™) unit through one of the analog input connection ports on the ICM. Each PTX can also interface with traditional automation equipment with suitable analog inputs such as Programmable Logic Controller (PLC), Distributed Control System (DCS), or Supervisory Control and Data Acquisition (SCADA) system.

The PTX is available with a 1.5 in. Swagelok Modular Platform Component (MPC) surface mount in accordance with ANSI/ISA 76.00.02 or with 1/4 in. or 6 mm Swagelok tube fitting end connections. It is UL® and ATEX certified for use in hazardous areas.

## Product Information

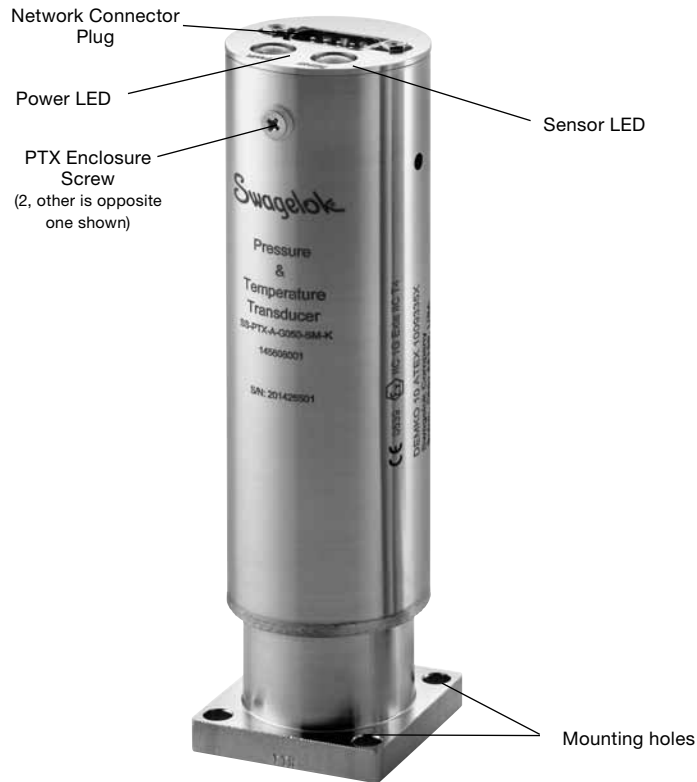


Fig. 1 PTX with MPC Modular Surface Mount Front View



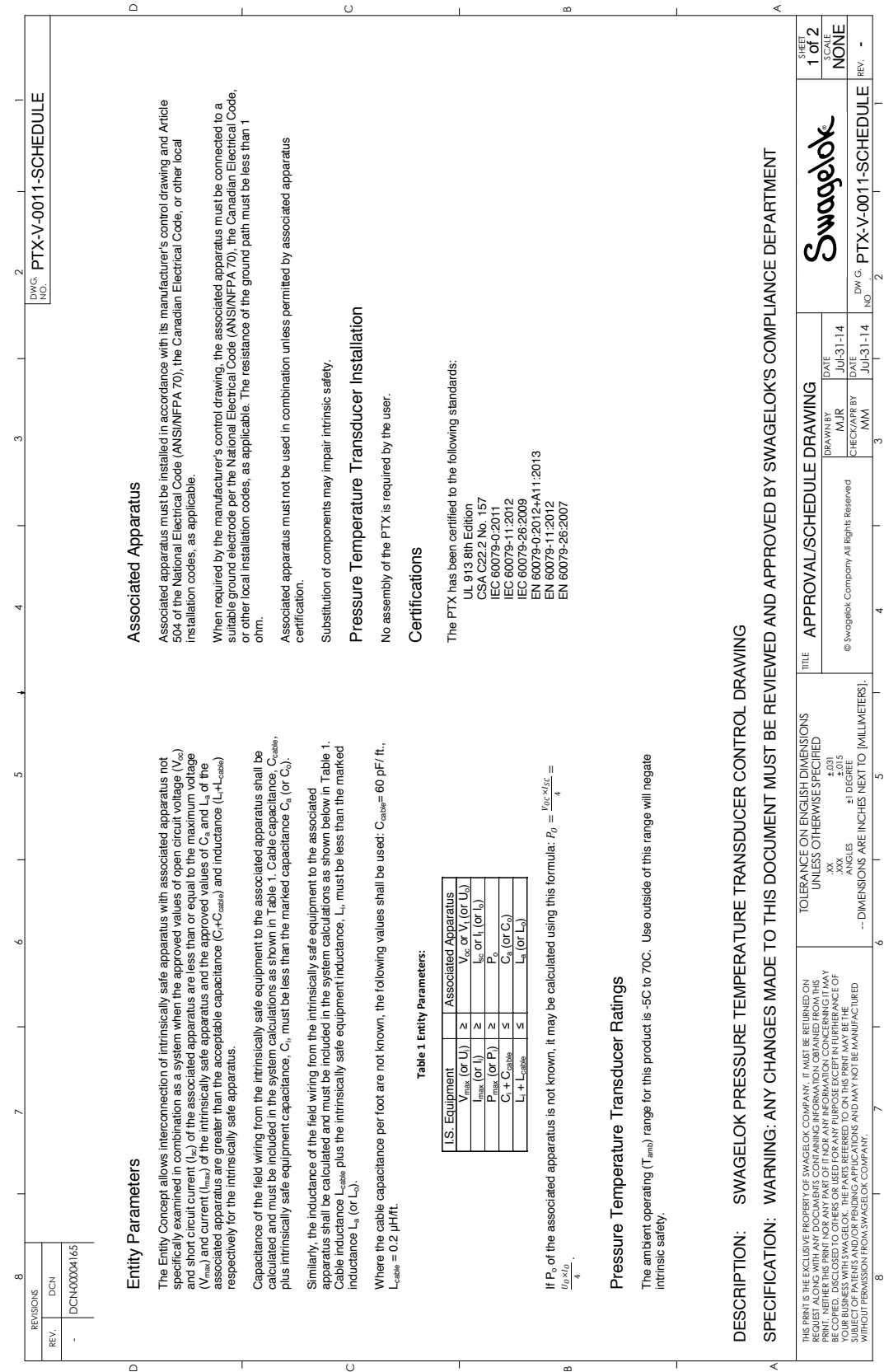
Fig. 2 PTX with Swagelok Tube Fitting End Connections

## Specifications

Power		
Voltage	9 to 28 V (dc), 24 V (dc), nominal	
Current	< 20 mA (dc) at 24 V (dc)	
Temperature (environment)		
Operating (Ambient)	Minimum	23°F (-5°C)
	Maximum	158°F (70°C)
Media	Minimum	23°F (-5°C)
	Maximum	158°F (70°C)
Storage	Minimum	-40°F (-40°C)
	Maximum	158°F (70°C)
Temperature Measurement		
Temperature Measurement	Measurement Range	23 to 158°F (-5 to 70°C)
	Accuracy, including: Repeatability Hysteresis Nonlinearity	± 9°F (± 5°C absolute accuracy)
Pressure		
Full-scale Range	0 to 50 psig (0 to 3.4 bar)	
	0 to 250 psig (0 to 17.2 bar)	
	0 to 500 psig (0 to 34.4 bar)	
Pressure Measurement	Accuracy, including: Repeatability Hysteresis Nonlinearity	± 2 % of full scale pressure of measurement
Overrange Pressure	2 × full scale	
Burst Pressure	5 × full scale	
Output Reading to Voltage Conversion		
Temperature	-40°F (-40°C) = 0.5 V (dc) 158°F (70°C) = 4.5 V (dc)	
Pressure	0 psig = 0.5 V (dc) full scale = 4.5 V (dc)	
Miscellaneous Data		
Weight	with MPC process connections	0.83 lb (375 g)
	with 1/4 in. and 6 mm Swagelok tube fitting end connections	1.27 lb (576 g)
Certifications	■ ANSI/NFPA Class I, Division 1, Groups A, B, C, D, Temperature Class T4 ■ UL 913 - Edition 8, UL 60079-0 - Edition 6, UL 60079-11 - Edition 6 ■ cUL® - CSA C22.2 NO. 157-92 - Edition 3 ■ ATEX Standards: EN 60079-0, EN 60079-11, EN 60079-26 ■ IEC: IEC 60079-0 - Edition 6, IEC 60079-11 - Edition 6, IEC 60079-26 - Edition 2	
Ingress Protection	IP64	
Electromagnetic Compatibility	EN 61326-1:2006 ■ RF Emissions: EN 55011 ■ ESD Immunity: EN 61000-4-2 ■ RF Immunity: EN 61000-4-3 ■ EFT Immunity: EN61000-4-4 ■ Conducted Immunity: EN 61000-4-6	
Vibration	Tested to IEC 60068-2-6:2007 ■ 10 to 150 Hz, at 2.04 g ■ 10 sweeps at 0.5 Octave/min	
Shock	Tested to IEC 6068-2-27:1987 ■ 50 g, 11 msec ■ 3 positive and 3 negative pulses each axis	
Entity Parameters	See Control Drawing: PTX-V-0011-SCHEDULE	

Note: Before installing the PTX in a hazardous location, review the control drawing on page 6. This will help ensure all electrical connections to and from the PTX comply with safety requirements. For an electronic copy of this manual, see [www.swagelok.com](http://www.swagelok.com).

Control Drawing



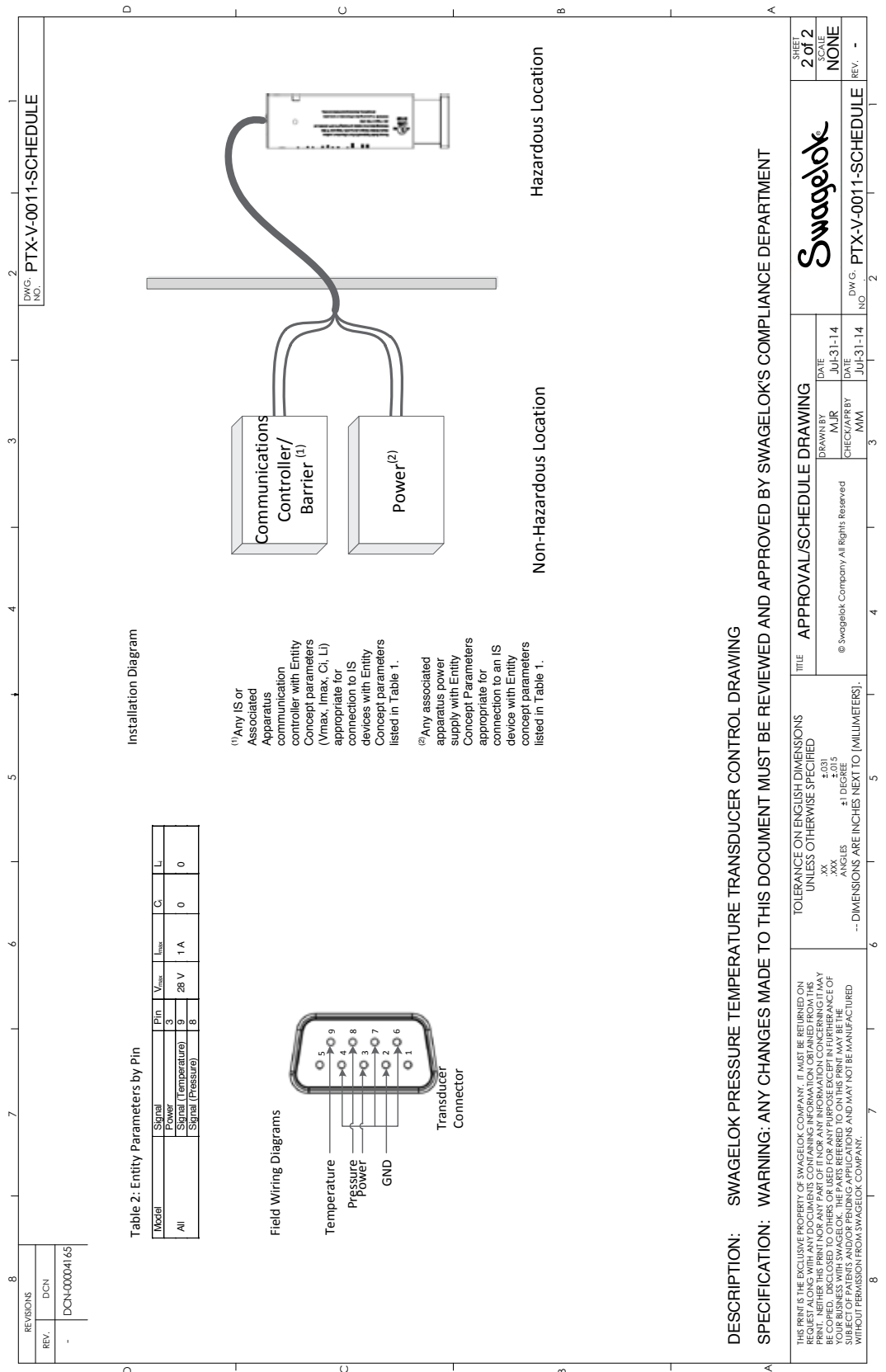


Fig. 3 PTX-V-0011-SCHEDULE continued

## Installation

### Mounting

A PTX with 1/4 in. or 6 mm Swagelok tube fitting process end connections should be installed in the system according to *Swagelok Tube Fitting Instructions for 1 in. (25 mm) and smaller fittings*, MS-12-01. Mounting holes are provided on the bottom of the PTX body. See below for dimension information.

A PTX with a 1.5 in. Swagelok MPC modular surface mount should be installed in the system according to the surface mount assembly instructions in the *MPC Series Modular Platform Components Assembly and Service Instructions*, MS-12-39.

Dimensions, in inches (millimeters), are for reference only and subject to change.

**NOTICE** Removal of the PTX enclosure screws will void the product warranty, damage the Ingress Protection rating, and negate the intrinsically safe hazardous location rating of the PTX.

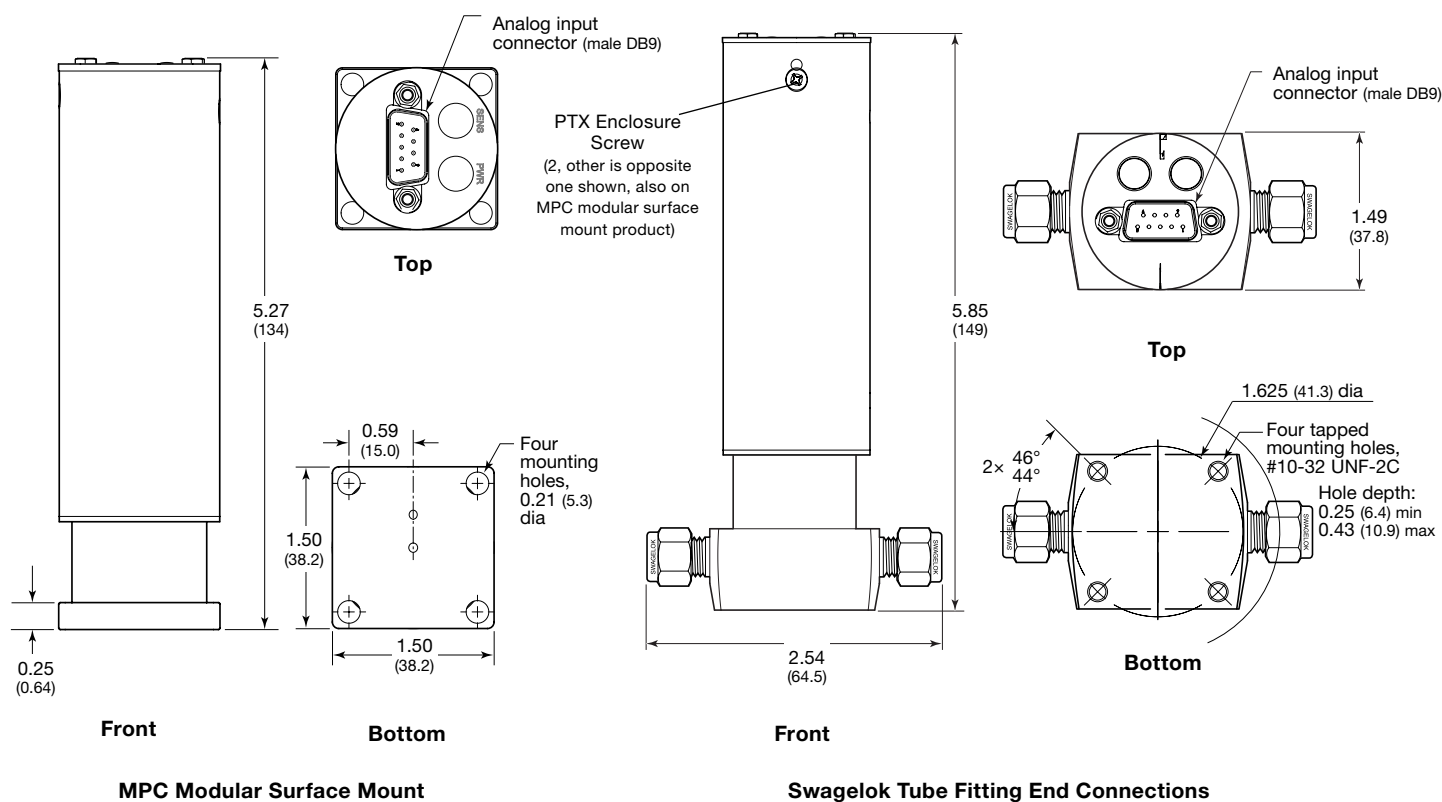


Fig. 4 Product Dimensions



## Power Supply

The intrinsically safe PTX can be used with any power supply capable of providing between 9 and 28 V (dc) and 50 mA per PTX in use. Supplying less than 9 V (dc) to the transducer will result in inaccurate measurements.

**NOTICE** Supplying more than 28 V (dc) can result in damage to the transducer.

## Hazardous Location Power Supply

When used in hazardous locations, a properly rated power supply must be used. The intrinsically safe PTX can be powered by any power supply identified as an intrinsically safe associated apparatus with output parameters of  $V_{oc} \leq 28$  V (dc) and  $I_{sc} \leq 1$  A.



### WARNING

A voltage higher than 28 V (dc) is outside the product's safety rating. Using a voltage outside the safety rating could result in an explosion.

## Interface Cable

### Cable Length

In non-hazardous locations, cable length is limited by the voltage drop for the power supply and the added noise on the pressure and temperature signal lines. It is recommended that transducer cables not exceed 100 ft (30.4 m) in length in order to minimize these effects.

### Hazardous Location Cable Length

The wire length between intrinsically safe equipment and associated apparatuses is determined by the interaction of the device entity parameters, as described in the following table. The parameter symbols and subscripts are defined in ATEX standards EN 60079-0 and EN 60079-11.

Parameter	Intrinsically Safe Equipment	Must Be	Associated Apparatus (ex. power source)
Voltage	$V_{max}$ (or $U_i$ )	$\geq$	$V_{oc}$ (or $V_t$ or $U_o$ )
Current	$I_{max}$ (or $I_i$ )	$\geq$	$I_{sc}$ (or $I_t$ or $I_o$ )
Power	$P_{max}$ (or $P_i$ )	$\geq$	$P_o$
Capacitance	$C_i + C_{cable}$	$\leq$	$C_a$ (or $C_o$ )
Inductance	$L_i + L_{cable}$	$\leq$	$L_a$ (or $L_o$ )

The cable between the two devices has a capacitance and inductance that must be added to that of the intrinsically safe equipment parameter. Once the entity parameters of the devices are known the maximum cable length can be calculated.

Where available, the manufacturer's specification for the cable's capacitance and inductance can be used. When the cable capacitance and inductance per foot are not known the following values must be used:

- $C_{cable} = 60$  pF/ft
- $L_{cable} = 0.2$   $\mu$ H/ft

The ATEX standards define additional safety factor rules that can apply when determining the maximum cable length. These do not apply in this case because the PTX has a capacitance ( $C_i$ ) and inductance ( $L_i$ ) of zero.

**Example**

Here is an example of using these parameters to determine the cable length.

1. Construct the entity parameter table for the known values:

Intrinsically Safe Equipment (Swagelok PTX)			Associated Apparatus (Power Supply)	
$V_{\max}$	28 V	$\geq$	9.5 V	$V_{oc}$
$I_{\max}$	1A	$\geq$	1A	$I_{sc}$
$P_{\max}$	-	$\geq$	-	$P_o$
$C_i + C_{\text{cable}}$	$0 \mu\text{F} + C_{\text{cable}}$	$\leq$	$0.5 \mu\text{F}$	$C_a$
$L_i + L_{\text{cable}}$	$0 \mu\text{H} + L_{\text{cable}}$	$\leq$	$8 \mu\text{H}$	$L_a$

The entity parameters  $P_{\max}$  and  $P_o$  can be ignored if the voltage and current parameters are compatible.

2. Calculate the maximum allowable cable capacitance and inductance.

$$C_{\text{cable,max}} = 0.5 \mu\text{F} - 0 \mu\text{F} = 0.5 \mu\text{F}$$

$$L_{\text{cable,max}} = 8 \mu\text{H} - 0 \text{H} = 8 \mu\text{H}$$

3. Calculate the maximum cable lengths using the maximum allowable capacitance and inductance.

$$\text{Length related to maximum capacitance} = C_{\text{cable,max}} / C_{\text{cable/length}} = 0.5 \mu\text{F} / 60 \text{ pF/ft} = 8333 \text{ ft (2539 m)}$$

$$\text{Length related to maximum inductance} = L_{\text{cable,max}} / L_{\text{cable/length}} = 8 \mu\text{H} / 0.2 \mu\text{H/ft} = 40 \text{ ft (12.1 m)}$$

The entity parameters will vary from one piece of apparatus to the next so the calculation must be done for each piece of apparatus in use.

**Cable Bend Radius**

The cable bend radius will vary according to the cable manufacturer's recommendations. A bend radius of 6 to 10 times the diameter of the cable is typical.

**Wiring Diagram**

The cables for the intrinsically safe PTX should be wired in accordance with Article 504 of the National Electrical Code (ANSI/NFPA 70). The connector for the PTX is a standard male DB-9. The cable will be a socket DB-9 with the pinout as described below.

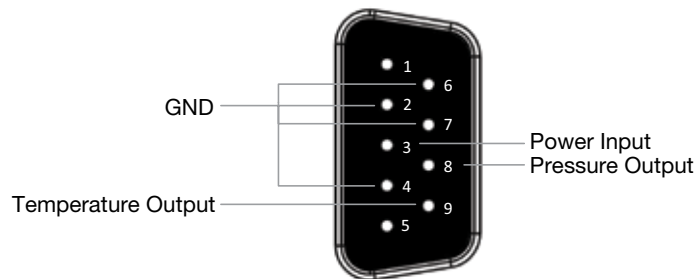
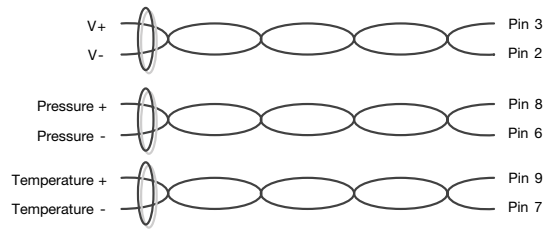


Fig. 5 Wiring Diagram

It is recommended the parameter measurement wires have their own connection to ground. A cable with three shielded, twisted pair is optimal to achieve this, as shown in Figure 6. This will ensure that the voltage drop which occurs with the flow of the operating current across the cable does not distort the temperature and pressure measurements.



*Fig. 6 Parameter Measurement Wire*

## Setup

1. Install the PTX into your system, see **Mounting**.
2. Connect the interface cable to the PTX and the network device.

## Maintenance

Additional assembly hardware for the MPC surface mount is available. Refer to *Modular Platform Components (MPC)*, MS-02-185, for ordering information.

There are no field-maintainable parts within the intrinsically safe PTX. Contact your authorized Swagelok representative for assistance.

**NOTICE** Removal of the PTX enclosure screws will void the product warranty, damage the Ingress Protection rating, and negate the intrinsically safe hazardous location rating of the PTX.

## Troubleshooting

Problem	Possible Cause	Remedy
<b>Power LED</b>		
Off	No power applied to the device.	Connect power.
Green	Normal operation.	No action needed.
<b>Sensor LED</b>		
Off	If the Power LED is also OFF, indicates no power applied to the device.	Connect power.
	If the Power LED is on, indicates sensor element failure.	Replace PTX unit.
Green	Normal operation.	No action needed.
<b>General</b>		
Output signal unchanged after change in pressure	Mechanical overload through overpressure	Replace PTX unit.
Signal value too small	Diaphragm is damaged, e.g. through impact.	Replace PTX unit.
Signal value dropping off / too small	Abrasive/aggressive media; corrosion of diaphragm/pressure connector; transmission fluid missing	Replace PTX unit.
Signal value erratic	Electromagnetic interference source in the vicinity	Shield the transducer and the cables. Remove the interference source.
	Working temperature too high / too low	Ensure temperatures within range of the transducer (see <b>Specifications</b> ).
Signal value incorrect	Working temperature too high / too low	Ensure temperatures within range of the transducer (see <b>Specifications</b> ).
No output signal	Cable break	Check connections and cable.
	Incorrect wiring or supply voltage	Check wiring and supply voltage.

Contact your authorized Swagelok representative for additional assistance.

## Warranty Information

Swagelok products are backed by The Swagelok Limited Lifetime Warranty. For a copy, visit [swagelok.com](http://swagelok.com) or contact your authorized Swagelok representative.

Each product catalog and user manual is up to date at the time of printing; subsequent revisions to individual product catalogs and user manuals will be posted to [www.swagelok.com](http://www.swagelok.com) and will supersede the printed version.

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Printed in U.S.A.  
January 2015, R0  
MS-13-229